

Challenges with Offshore Grid Connections

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Targets for Offshore Wind Development

- The German Government fosters the transformation to renewable energy generation and strongly supports the offshore wind development.
- The legal and regulatory framework focuses on:
 - timely building on command for on the spot requirements
 - minimised environmental impact
 - availability and efficiency

TenneT Grid Connections

- 5 GW transmission capacity ordered
- 0,46 GW in operation

OWF Projects

- 24 projects approved
- Further 50 planned

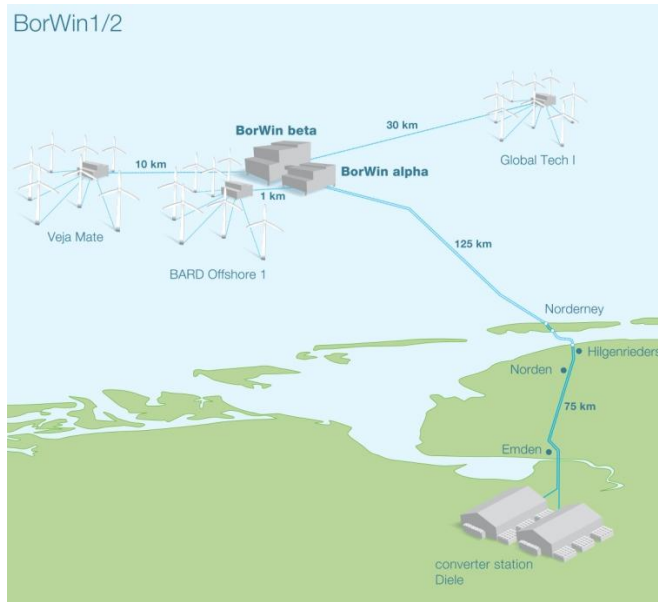
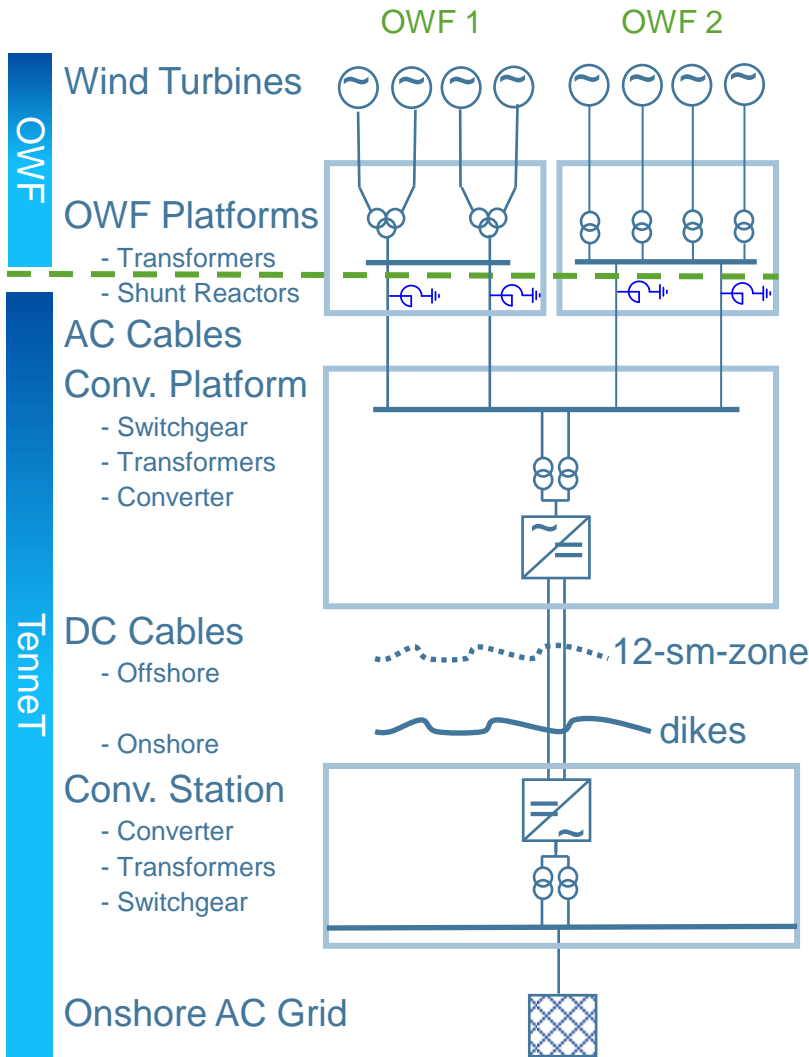
Industry Expectations (dena II)

- 14 GW until 2020

Governmental Targets

- 10 GW until 2020
- 25 GW until 2030

Long Distance and Large Scale Connection Concept



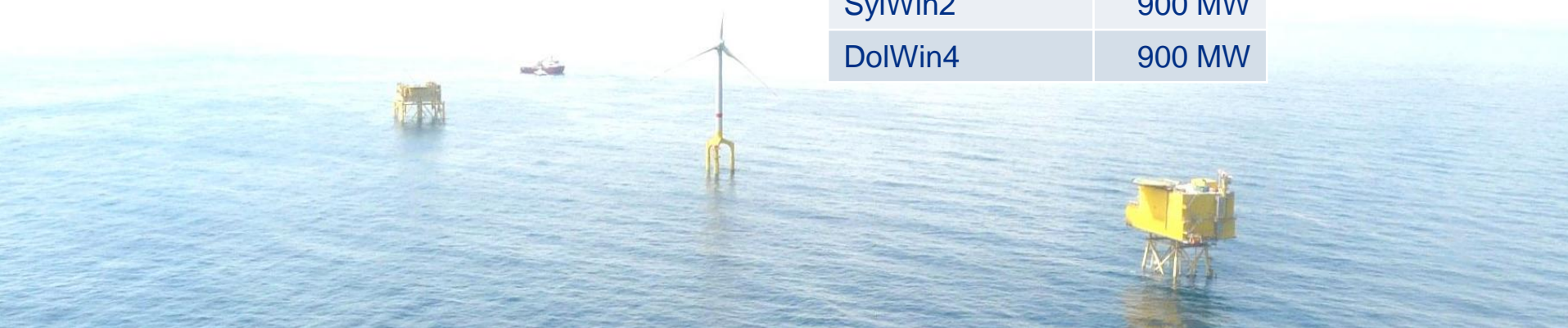
- ✓ optimised number of cable systems
- ✓ standardised interface to OWFs
- ✓ partial redundancy via parallel systems
- ✓ cost efficient solution
- ✗ additional converter platform

TenneT's Offshore Grid Connection Projects

In Construction	Capacity	Completion
BorWin2	800 MW	2013
DoIWin1	800 MW	2013
DoIWin2	900 MW	2015
HelWin1	576 MW	2013
HelWin2	690 MW	2015
SylWin1	864 MW	2013
Riffgat	108 MW	2012

In Operation	Capacity	Completion
BorWin1	400 MW	2009
Alpha ventus	60 MW	2009

In Development	Capacity
DoIWin3	900 MW
BorWin3	900 MW
BorWin4	900 MW
SylWin2	900 MW
DoIWin4	900 MW



Challenges with Offshore Grid Connections (1)

Legal and Regulatory Framework

- high investment volumes
- build on command and on spot legal requirements
- lack of synchronisation between off- and onshore grid extensions
- limited cable corridors and construction windows
- request for unrealistic short realisation times and parallel licensing
- overload of suppliers, authorities and other stakeholders



Challenges with Offshore Grid Connections (2)

Technical Risks

- “new“ technology in a ”new“ environment
 - lack of standardisation and references
 - lack of construction and maintenance concepts
 - grid stability and power quality
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- risks for availability of the system and reliability of components
 - risks for lifetime of offshore installations and life cycle costs



Biggest Levers for Acceleration and Reliability

Offshore Grid Plan

- planned pipeline of offshore grid connections
- planned cable corridors and platform positions
- synchronisation of off- and onshore grid planning
- standardised system requirements

Standardisation

- DC-connections to onshore: 900 MW, 320 kV
- AC-connections to OWFs: 150 MW, 155kV, ~ 20 km
- platforms: standards for certification

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